necessary, in preparing for an approaching opposition of *Mars*, to make more than five, or at the most seven constructions, the middle one for the day of opposition, since the intermediate positions of the pole and equator of *Mars* can be readily estimated with amply sufficient exactness.

In a future paper I propose to make a few remarks (i) on the completion of the projection of a planet's disk after the position of the poles and equator have been determined; (ii) on the determination of the central areographic longitude for any given epoch; and (iii) on the determination of the centre of illumination.

On the Proper Motion in Right Ascension of η^2 Draconis.

By A. W. Downing, Esq.

My attention was attracted to this star by reading in the preface to the *Nautical Almanac* that the proper motion adopted was that given in Mädler's *Bradley*, and on looking further into the matter I find that from 1848 to 1873 the proper motion in R.A. used in the *Nautical Almanac* was $+0^s\cdot023$, this being the value given in the British Association Catalogue, and since that time $+0^s\cdot005$, taken from Mädler's *Bradley*, has been used. The British Association Catalogue value, $+0^s\cdot023$, has also been adopted in the Greenwich Catalogues since 1845, the Right Ascension of η^2 *Draconis* not being given in the *Fundamenta*, though the Declination is, and consequently the proper motion in the former element has not been computed by Mr. Main or Mr. Stone, whose determinations are based on the *Fundamenta*. The proper motion used in the American *Nautical Almanac* is $+0^s\cdot0024$. As I found that these three authorities differed, I determined to calculate the proper motion in R.A. afresh from the materials afforded by the best available Catalogues.

For this purpose I have, by the kind permission of the Astronomer Royal, used as an assumed R.A. for $1872\cdot0$ the place given in the Greenwich Nine-Year Catalogue, so that—supposing the proper motion $=0$— we have for any time

$$\alpha = 16^h\ 22^m\ 15^s\cdot668 + 0^s\cdot8017\ (t-1872) + 0^s\cdot0000939\ (t-1872)^2, \qquad (1)$$

and from this formula I have computed the R.A. for the epoch of each of the Catalogues used.

The following is a list of the Catalogues:–

Catalogue	Mean Year of Epoch	Mean Year of Obs.	Weight
Piazzi	1800	1800	2
Groombridge	1810	1806·8	2
Struve (Cat. Gen.)	1830	1824	3
Pond	1830	1830	2
Madras (Taylor)	1835	1835	½
Armagh	1840	1832·6	½
Greenwich	1840	1839	4
Washington (Gilliss)	1840	1841·5	2
Radcliffe	1845	1841·9	3
Greenwich	1845	1844	4
Poulkova	1845	1849·7	6
Greenwich	1850	1851·1	4
Washington	1860	1852·5	2
Greenwich	1860	1858·1	4
Radcliffe	1860	1858·5	2
Greenwich	1864	1865·1	3

The places given in the various Catalogues have been reduced to Professor Newcomb's Standard (*Washington Observations for* 1870, *Appendix III.*), and have also been corrected for the part of the proper motion, if any, which has been applied to the observed place in reducing it to the epoch of the Catalogue. Then the differences between the Catalogue places thus corrected and the R.A.'s computed by means of formula (1) have been found; whence, by the method of least squares, we have the normal equations:—

$$44\,\Delta\alpha - 1291\,\mu = +2^s\cdot5,$$
$$-1291\,\Delta\alpha + 49354\,\mu = -26^s\cdot494,$$

where $\Delta\alpha$ is the correction to the assumed R.A. and μ is the proper motion in R.A. for 1872; therefore

$$\Delta\alpha = +0^s\cdot177,$$
$$\mu = +0^s\cdot00408,$$

and (1) becomes

$$\alpha = 16^h\,22^m\,15^s\cdot845 + 0^s\cdot8058\,(t-1872) + 0^s\cdot0000937\,(t-1872)^2$$

I may add that the values of the proper motion in N.P.D. given by the authorities cited above agree fairly well.